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LIQUID CRYSTAL DISPLAY DEVICE

[Abstract]

PROBLEM TO BE SOLVED: To overcome such problems of a liquid crystal display device in which liquid crystal is filled by forming protruded patterns on one substrate of the two parallel substrates and gaps between the other substrate, wherein light escaping is caused due to a portion where the rubbing is not uniformly performed in the vicinity of protruded patterns in rubbing to degrade image quality, and when arranging patterns covering the light escaping portion by the light shielding layer in the whole pixel to prevent the light escaping, opening ratios fall down to deteriorate luminance.

SOLUTION: Only a light shielding layer 6b of a pixel where protruded patterns 11

is disposed is extended to form a light shielding part 6c at the lower part in the rubbing direction of the protruded patterns in the opening part 6d and the extended light shielding part is not formed about a light shielding layer 6a in a pixel where the protruded patterns are not disposed to widen the opening part 6d, thereby achieving a liquid crystal display device having high image quality and high luminance.

[Claims]

[Claim 1] A liquid crystal display device characterized in that two parallel substrates are provided, a light shielding layer having an aperture is formed at every pixel of one substrate, a protruding pattern is formed at part of the light shielding layer of a plurality of specific pixels, and liquid crystal is filled in a gap that is formed between the two substrates by the protruding pattern, wherein a light shielding part is extendingly formed at an aperture only of a light shielding layer where the protruding pattern is formed, and the aperture has a shape different from that of an aperture of a light shielding layer where the protruding pattern is not formed.

[Claim 2] The device of claim 1, wherein the light shielding part of the light shielding layer where the protruding pattern is extended to form at an aperture corresponding to a lower portion of the rubbing direction of the protruding pattern.

[Title of the Invention]

LIQUID CRYSTAL DISPLAY DEVICE

[Detailed Description of the Invention]

[Field of the Invention] The present invention relates to a liquid crystal display device in which a protruding pattern is formed on one substrate of two parallel substrates, a gap is formed by the protruding pattern between the two substrates, and liquid crystal is filled in the gap.

[Description of the Prior Art] Figures 3 and 4 depict a prior art liquid crystal display device of such a kind, wherein Figure 3 is an enlarged view of a light shielding layer and Figure 4 is a sectional view taken along line B-B of Figure 3. As shown in Figures 3 and 4, an array chip 2 and an alignment layer 3 are formed on a glass substrate 1, thereby forming a thin film transistor substrate 4 (hereinafter, a thin film transistor is referred to as a TFT.). A light shielding layer 6, a colored layer 7, an opposing electrode 8 and an alignment layer 9 are sequentially laminated on a glass substrate 5, and a protruding pattern 11 is formed at a light shielding layer 6 of a plurality of specific pixels, thereby forming an opposing electrode substrate 10.

Then, the opposing electrode substrate 10 is attached to the TFT substrate 4, and liquid crystal 12 is injected into a gap which is formed between the TFT substrate 4 and the opposing electrode substrate 10 by the protruding pattern 11, thereby constructing a liquid crystal cell. A thickness of the liquid crystal cell is maintained by the protruding pattern 11.

[Problem(s) to be solved by the Invention] However, the prior art liquid crystal display device having such a structure has the following problems. As the protruding pattern is formed at the opposing electrode substrate, a portion where rubbing is not uniformly performed is generated. Also, if the light shielding layer 6

having the protruding pattern 11 is formed like a light shielding layer 6a having an aperture as shown in Figure 5, image quality is remarkably degraded by, for example, light escaping, in displaying an image. In order to prevent the light escaping, if the light shielding layer 6 is formed like a light shielding layer 6b in which a light shielding part 6c is extendingly formed at an aperture 6d as shown in Figure 3, an aperture of every pixel becomes too small to secure brightness enough for a liquid crystal display device to display an image.

To solve the problems of the prior art, it is an object of the present invention to provide a liquid crystal display device with high image quality and high brightness.

[Means for Solving the Problem] To attain the aforementioned object, in the present invention, a light shielding part is extendingly formed only at an aperture of a light shielding layer of a pixel where a protruding pattern is formed, and a light shielding layer of a pixel where a protruding pattern is not formed has an aperture without an extendingly-formed light shielding part.

By the present invention, because the aperture of the light shielding layer including the protruding pattern is small, the portion where the rubbing is not uniformly performed due to the formation of the protruding pattern can be covered with the light shielding part which is extendingly formed, and degradation in image quality due to the ununiform rubbing can be prevented. Also, because the extendingly-formed light shielding part is not formed at a light shielding layer where the protruding pattern is not formed, the brightness can be improved as compared to a liquid crystal display device having a large light shielding layer at every pixel. Accordingly, the present invention may implement a liquid crystal display device with high image quality and high brightness.

[Embodiment of the Invention] According to claim 1, in a liquid crystal display device characterized in that two parallel substrates are provided, a liquid crystal layer having an aperture is formed at every pixel of one substrate, a protruding pattern is formed at part of the light shielding layer of a plurality of specific pixels, and liquid crystal is filled in a gap formed between the substrates by the protruding pattern, a light shielding part is extendingly formed at an aperture only of a light shielding layer having the protruding pattern, and the aperture has a form different from that of an aperture of a light shielding layer where the protruding pattern is not formed.

Therefore, a portion where the rubbing is not uniformly performed due to the formation of the protruding pattern can be covered with the light shielding part so that deterioration of image quality due to the portion where the rubbing is not uniformly performed can be prevented. Also, because the light shielding layer of other pixels has an aperture without a light shielding part, the brightness can be improved as compared to the prior art liquid crystal display device in which a light shielding part is extendingly formed at a light shielding layer of every pixel.

Moreover, in a liquid crystal display according to claim 1, as for invention according to claim 2, the light shielding part of the light shielding layer where the protruding pattern is formed is extendingly formed at an aperture corresponding to a lower portion of the rubbing direction of the protruding pattern.

By such a structure, the extendingly-formed light shielding part covers only a portion where a rubbing is not uniformly performed due to the protruding pattern, so that deterioration in image quality caused by the portion where the rubbing is not uniformly performed due to the formation of the protruding portion can be prevented.

The embodiment of the present invention will now be described with reference to accompanying drawings. Figures 1 and 2 show a liquid crystal display device in accordance with one embodiment of the present invention. Figure 1 is an enlarged view of a light shielding layer, and Figure 2 is a sectional view of a liquid crystal display device, taken along line A-A of Figure 1.

As shown in Figure 2, an array chip 2 and an alignment layer 3 are formed on a glass substrate 1, thereby forming a TFT substrate 4. A light shielding layer 6, a colored layer 7, an opposing electrode 8 and a alignment layer 9 are sequentially laminated on a glass substrate 5, and a protruding pattern 1 is formed at part of the light shielding layer 6 of a plurality of specific pixels, thereby forming an opposing electrode substrate 10.

The TFT substrate 4 and the opposing electrode substrate 10 are attached together, and liquid crystal 12 is injected between the TFT substrate 4 and the opposing electrode substrate 10, thereby forming a liquid crystal cell. A thickness of the cell is maintained by the protruding pattern 11 of the opposing electrode substrate 10 between the substrates.

In the light shielding layer 6 of Figure 1, as for a light shielding layer 6a of a specific pixel where the protruding pattern 11 is formed, a light shielding part 6c is extendingly formed at an aperture 6 corresponding to a lower portion of the rubbing direction (direction of the arrow) of the protruding pattern 11. As the light shielding part 6c is extendingly formed, the light shielding layer can cover the portion where the rubbing is not uniformly performed due to the protruding pattern 11, so that degradation of image quality of the liquid crystal display device due to the formation of the protruding pattern 11 can be prevented.

Also, a light shielding layer of a pixel where the protruding pattern is not

formed is formed like a light shielding layer 6a without an extendingly-formed light shielding part as shown in Figure 5. Accordingly, a panel implementing high brightness can be obtained as compared to the prior art where a light preventing layer 6 of ever pixel is constructed like a light shielding layer 6b shown in Figure 3.

Then, a specific example of the present invention will now be described. In Figures 1 and 2, the protruding pattern 11 is formed as a cylindrical shape with a diameter of 10 micrometers and a height of 5 micrometers and is formed at every three pixels. A pitch of the pixel is 100 micrometers wide and 300 micrometers long, and the light shielding layer 6a is formed from an end surface of the pixel up to 20 micrometers inside.

The protruding pattern 11 is formed at the center of a light shielding layer of a pixel surface. As for the light shielding layer 6b of a pixel in which the protruding pattern 11 is arranged, only a right portion from the center of an upper side is set to 50 micrometers, a right portion from the center of the upper side is set to 20 micrometers and other sides are also set to 20 micrometers. A direction of rubbing of the opposing electrode substrate 10 having the protruding pattern 11 is a direction of the arrow of Figure 1 (a direction from the upper right of a pixel to the lower left).

In this specific example, as an upper side of a light shielding portion of a pixel is made to be 30 micrometers larger than usual, the portion where the rubbing is not uniformly performed can be covered. Also, an aperture can be improved up to 50.3%, as compared to the prior art structure in which a light shielding layer 6b is used for every pixel and an aperture ratio is 47.0%.

[Effect of the Invention] As described so far, in accordance with the present invention, a light shielding part is extendingly formed at an aperture only of a light

shielding layer of a pixel where a protruding pattern is formed and thus the aperture becomes different from an aperture of a light shielding layer of another pixel, so that a portion where the rubbing is not uniformly performed due to the formation of the protruding pattern can be covered with the light shielding layer, and the deterioration of image quality due to the portion where the rubbing is not uniformly carried out can be thusly prevented. Also, as for a light shielding layer of another pixel, a wider aperture without an extendingly-formed light shielding part is formed. Accordingly, as compared to the prior art liquid crystal display device, the present invention can improve the brightness.

[Description of Drawings]

Figure 1 is an enlarged view of a light shielding layer of a liquid crystal display device in accordance with one embodiment of the present invention;

Figure 2 is a sectional view of the liquid crystal display device, taken along line A-A of Figure 1;

Figure 3 is an enlarged view of a light shielding layer of the prior art liquid crystal display device;

Figure 4 is a sectional view of the liquid crystal display device, taken along line B-B of Figure 3; and

Figure 5 is an enlarged view of the light shielding layer without an extendingly-formed light shielding part.